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Number 4
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Wood As Energy

An Overview : Wood Energy Markets

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Prepared by the staff of
National Agricultural Library
Joseph H. Howard, Director

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INTRODUCTION

This information package represents an effort on the part of the staff of the National Agricultural Library to assemble a variety of information about an important current topic. The lead essay prepared by a knowledgeable expert in the field discusses in some depth the specific issue.

FROM THE LITERATURE provides a representative sampling of literature available on the subject. Much of these materials were selected from the AGRICOLA database of the National Agricultural Library. An NAL call number is given for titles in the collections of the Library. The Library does not maintain a collection of audiovisual materials in this subject area. Sources are listed from which slide and filmstrips may be acquired.

The listings of **CURRENT RESEARCH** and **DEMONSTRATION PROJECTS** are taken from several databases. CRIS (Current Research Information System) is a computer based information storage and retrieval reporting system for publicly supported agricultural and forestry research in the United States. For further information contact Current Research Information Systems, NAL Building, Beltsville, MD 20705 (telephone 301-344-3850). Descriptions of demonstration projects were provided by the NARS (Narrative Accomplishment Reporting Systems) of the Extension Service, USDA, NAL Building, Beltsville, Md, 20705, telephone (301) 344-3750.

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Number 4

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WOOD ENERGY MARKETS

By Ian Hardie, Associate Professor Dept. of Agricultural and Resource Economics, College of Agriculture Univ. of Maryland, College Park Md.

The potential role wood fuels will play in satisfying the future energy needs of the United States depends in large part on the ability of these fuels to compete in the market place with other energy sources. Prior to the 1973-74 oil embargo, there was little doubt that wood had lost its competitive advantage. From being the dominant source of energy in the United States for more than a century (Clawson, 1979), residential use of fuelwood had declined by 1970 to a point where less than 2 percent of all U.S. households used wood as their primary fuel for heating and less than 1 percent as their primary cooking fuel (U.S. Forest Service 1980). Industrial use also declined, until by 1976 nine-tenths of the total wood used to produce steam heat or electricity in the country was consumed within the wood processing industry itself.

The U.S. Department of Energy believes the United States could obtain one-fifth of its energy needs from renewable energy forms by the year 2000 (U.S. Dept. Energy 1979). This would amount to some 19 quadrillions of BTU's (quads) of energy. The potential contribution of biomass to this production goal has been projected to be from 3 to 8 quads (Del Gobbo 1978, Zerbe 1977). Current production of energy from wood in the United States is about 2 quads, so the productions presume a substantial expansion in the wood energy markets within the next 20 years. Whether or not such an expansion will be realized depends almost completely on economic considerations, for it is generally agreed that the nation has sufficient wood resources to realize these energy projections (Carpenter 1980, CORRIM 1977).

The forest products industry accounts for two-thirds of the current consumption of wood fuels, producing about 1.2 -1.3 quads of energy annually (Hewitt et al., 1980). Despite this substantial production, the industry is only about 40-50 percent energy self-sufficient, and is the fourth largest purchaser of industrial energy in the United States (U.S. Forest Service 1976). The presence of mill residues and the opportunity to obtain forest residues as part of their logging operations put this industry in a particularly good position to achieve greater energy self-sufficiency (Grantham 1978, Salo et al. 1978). The costs of wood fuel should be lower and the materials handling experience higher for the industry than for any other potential industrial user.

Costs of obtaining the fuel is only one consideration in the economics of energy production from wood. Costs of installing and maintaining woodfired boilers may double corresponding costs for oil or gasfired units (Koch and Mullen 1971). Capital costs may also discourage investment in woodfired boilers. Installation of a new boiler can cost between 12-25 million dollars (Salo et al.

1978), and retrofitting a 1400 barrel/day oil fired unit was estimated to require an additional capital investment of $21.5 million (Karchesy and Koch 1979). Annual operating and maintenance costs would increase by $2.3 million for the retrofitted unit, but fuel costs would decrease by $4.2 million. In addition, the boiler efficiency may vary substantially with the moisture content of the wood input and additional costs may have to be incurred to dry the wood before is is used (Levi and O'Grady 1980).

Except for a few isolated cases, industrial energy users outside the forest products industry do not produce energy from wood (Hewitt et al. 1980, list only three examples: the Russell Corporation in Alabama, the Burlington, Electric Department in Vermont, and the Eugene Water and Electric Board in Oregon). The potential of the users to enter this production will depend in large part on their ability to obtain the wood fuels, for they should be able to use the same generating technology as the forest products industry. One favorable factor to these firm's employment of wood residues is the heterogeneity of residue production within the forest products industry. Sawmills account for four-fifths of these by-products and most of the remaining production occurs at plywood mills (Smith 1980). Thus, some firms within the forest products face a residue disposal problem and should be willing to sell wood fuels. In a recent survey of Georgia firms (Ames and Baxter 1981) found that mill residues purchased from sawmills and transported 30 miles had a significantly lower delivered price per million BTU's than coal, fuel oil or natural gas. Thus, firms not in the forestry industry but close to mills with surplus residues should have a good source of wood fuels for energy production.

Although mill residues are not yet completely utilized, substantial increases in the industrial use of wood for energy would have to depend on forest residues for raw material supplies. At present, these residues are almost completely unutilized for energy production, and the potential of producing wood fuels from logging and thinning operations is just beginning to be explored. Case studies of five harvesting operations, including two mechanized thinning operations, two land clearing operations and one experimental relogging operation for hardwood tops and limbs, found costs of production to range from $9.16-$75.15 per green ton of chips (Arola and Mirjata 1981). Transportation distances incorporated into these estimates ranged from 10-40 miles one way, yields of harvested products ranged from 47 - 78 tons per acre, and stumpage prices paid to the landowner varied from $.60 - $1.20 per harvested ton. Increases in gasoline costs would raise these figures somewhat, and they are specific to Michigan. Even so, they compare favorably with the finding by Karchesy and Koch that one green ton of Southern pine-site hardwoods would generate the same amount

of steam as $15 of natural gas. This suggests that forest residues may be competitive with other fuels on a delivered basis if the transport distance is not too great.

Standard harvesting techniques were used in the case studies to obtain the wood fuel. However, one firm, Morbark Industries, has taken the additional step of designing an integrated logging and milling operation which includes wood fuel production as a planned integral part of the production process. Wood residues are obtained in this operation both in the woods and from the milling process and are produced to be marketed to other firms (Burkholder 1980). Such integrated operations appear to be an economically feasible way to produce wood fuels, and may increase the market potential of wood for energy. Another option involving technical innovation is the production of wood in silvicultural biomass farms. Although this option received considerable attention in the late 1970's, it has not proved to be an economically feasible alternative (Mitre Corp. 1978, Zeimetz 1979).

Most energy produced from wood outside the forest products industry is produced by residential users for home heating. This use has increased more rapidly than industrial use during the 1970's and residential energy production may now amount to 0.2 quads to 0.8 quads of energy annually (Hewitt et al 1980). The shift from fossil to wood fuels has centered in the Pacific Northwest, the Upper Lake States, the Northeast and the Southeast where forest resources are plentiful and where significant portions of the population live in a rural setting. The adoption of wood as a heating fuel is especially prevalent in New England where 32% more wood was burned during the winter of 1978-1979 than in the winter two years earlier (Wheeling 1980). In New Hampshire, for example, 50 percent of all homeowners used woodburning stoves or central woodfired heating systems as a source of residential energy (Bailey and Wheeling 1982). This compares to an estimated 5 percent in 1970.

Surveys in New England and the Northeast indicate that 55-70 percent of the wood consumed in household heat production is cut by household members rather than purchased from fuelwood venders. Most of this harvest takes place on private woodlands instead of public forests, and most of the wood cut comes either from dead standing or fallen trees. Perhaps because of the costs of locating and transporting this wood, rural areas have a higher percentage of households burning wood than urban areas. Most residential fuelwood is burned in an air tight stove by households who consume 4-6 cords of wood per year and who obtain over 50 percent of their heat requirements from this energy source.

Although the rapid use in wood consumption attests to the potential of wood as a residential heating fuel, the shift from fossil fuels is still too recent to assess the long term potential of this wood use. Cutting wood and operating a stove is a very labor intensive process with a cost that depends heavily on how a household values its time. Even with a moderate assigned wage rate of $5 per hour, over 85 percent of the total cost of acquiring and burning a cord of wood is attributable to labor (White and Wilson 1980, 1981). These labor costs can be expected to rise over time as the readily accessible dead and fallen trees situated next to a road are depleted, and as individuals must travel farther into the woods and farther from home to obtain their firewood. Whether wood cutting will become a way of life, purchased wood supplies will gradually replace household wood cutting, or the amount of wood burned in the stove or furnace will decrease, is not yet known. The long term potential of wood as a residential energy source will depend in large part on how this wood procurement system evolves. It will effect both the continued utilization of wood by wood burning households and the entry of households into the wood fuel market who do not now heat with wood.

The production of energy from wood may also involve the creation of other fuel products from the wood resource. Examples include charcoal, pelletized wood, methanol or ethanol, and low BTU or producers gas. As wood is converted to other fuel forms, its total potential heat value is substantially reduced due to the energy required for conversion. The converted fuel is, however, easier to store, transport and use. Close-coupled operations in which wood is first converted may have some potential in industrial applications. The rest of these processes are still largely experimental. Their market potential appears limited at present, either because they are too costly or because the converted fuel products can be made more efficiently from natural gas or coal (Youngs 1980, Hewitt et al. 1980, Karchesy and Koch 1979).

NOTE: Legislation now encourages continuous operation of wood burning by requiring utilities to buy back electicity from these co-generators in off-peak, which makes it much easier for a potential woodburner to justify an expensive installation, given this added assurance that it could be operated around the clock, and the excess energy above the needs of the firm can be sold. Donald E. Nelson, National Program Leader, Wood Products Marketing, Extension Service, USDA.

FROM THE LITERATURE

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(NAL Call No.: aSD11.U52)

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(NAL Call No.: F76 Frr No. 22)

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(NAL Call No.: A281.9AG8A)

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(NAL Call No.: 99.8 F7692)

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Can the Marketing of Wood Manufacturing Residue be Improved. D. O'Brien and S. A. Sinclair. Forest Products Journal 31(3)30-32. March 1981.
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(NAL Call No.: 100N454R)

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Firewood Cash Crop Potential Grows. J. McDowell. Countryside:64(10)26-27. October 1980.
(NAL Call No.: S521.C62).

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(NAL Call No.: aSD11.A35)

Maine's Secondary Wood Industry: a Utilization Summary and Directory. Merle E. Ring, Jr. and Jean W. Nolley; in cooperation with USDA Forest Service, Northeastern Area State and Private Forestry. Augusta Maine Dept. of Conservation, Bureau of Forestry, 1979. 46 p.
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Marketing Urban Wood Residues. J. W. Howard. Asheville, N.C., USDA Forest Service General Technical report SE. 16:81-84. Sept. 1979.
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(NAL Call No.: SD435.T550)

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Ralph T. Monohan and Jeffrey L. Wartluft. Washington, D.C., U.S. Dept. of Agriculture, Forest Service, February 1980. 25 p. (NA-FR-17).

Selling Timber Harvest in a Metropolitan Area (California).
D. F. Olderman. Portland, Ore., In Pacific Logging Congress, Loggers Handbook 40:12-13.
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Separating and Marketing Quality Hardwoods. R. F. Westbrook. Asheville, N.C., Hardwood Research Council. Proceedings Annual Hardwood Symposium, (8th) Asheville, N.C., 1980. p. 81-85.
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(NAL Call No.: 99.9 S0131978)

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(NAL Call No.: TP360.P77)

Wood Fuels for Today and Tomorrow. Larry G. Jahn. Extension Review. Winter 1982. p. 18-19.
(NAL Call No: 1EX892EX)

FILMS

Fuel from the Forest: Better Management Through Firewood Harvesting. Cornell Cooperative Extension, 1982. 26 minutes in color. Available in 16 mm or video-tape.

Cost: Printed, $16 for three days; Purchase: $350 or 16 mm, and $175 for video-tape; previews available at rental rate.

Contact: Audio Visual Resource Center
Cornell University
8 Research Park
Ithaca, NY 14860
(604) 256-2091

CURRENT RESEARCH AND DEMONSTRATION PROJECTS

ANALYSIS OF THE FUELWOOD MARKETING AND DISTRIBUTION SYSTEM IN VERMONT

0078083
AGENCY: CSRS VT.Z
PERIOD: 23 OCT 78 TO 30 SEP 83
INVEST: BOUSQUET D
PROJECT#: VT00036
PERF ORG: FORESTRY
LOCATION: UNIVERSITY OF VERMONT
BURLINGTON VT

OBJECTIVES: Idenfity and describe the physical structure and function of the existing fuelwood marketing and distribution system in Vermont. This will include definition of producer, product, channel and ultimate consumer characteristics and requirements. Evaluate the economic performance of the fuelwood processing system. This will include analysis processing, efficiency, costs and returns and costs of fuelwood delivered to consumer.

PUBLICATIONS: 81/10 82/09
BOUSQUET. 1982. Vermont Fuelwood Production and Marketing, University of Vermont School of Natural Resources, Burlington, Vermont. 138 pages.

ECONOMIC IMPACTS OF ENERGY USE AND DEVELOPMENT (OBJECTIVE 4)

0046918
AGENCY: ERS NRED
PERIOD: 01 OCT 79 TO 30 SEP 82
INVEST: NOT PROVIDED
PROJECT#: NRED-42-4
PERF ORG: ECONOMIC RESEARCH SERVICE
LOCATION: 14TH & INDEPENDENCE ST S. BLDG
WASHINGTON DC

OBJECTIVES: Determine the importance of locally-produced fuelwood to RC&D areas in the New England States, including analyses of supply and demand factors affecting the potential of fuelwood for home heating.

PUBLICATIONS: 81/10 82/09
BAILEY, M. and WHEELING, P. 1982. Wood and energy in Vermont. ERS Staff Report, No. AGES820126, (March) 50 pp.
BAILEY, M. and WHEELING, P. 1982. Wood and energy in New Hampshire. ERS Staff Report, No. AGES820604, (June) 48 pp.
BAILEY, M. and WHEELING, P. 1982. Wood and energy in Maine. ERS Staff Report, No. AGES820817, (September) 50 pp.

HOUSEHOLD FIREWOOD CONSUMPTION IN SOUTH CAROLINA

0082490
AGENCY: OCI SC.Z
PERIOD: 01 APR 80 TO 31 MAR 82
INVEST: MARSINKO A P; WOOTEN T E
PROJECT#: SCZ00058-FR
PERF ORG: FORESTRY
LOCATION: CLEMSON UNIV
CLEMSON SC

OBJECTIVES:Determine quantity, size, and prices of firewood being burned by households in South Carolina. Determine the types of devices in which firewood is burned and sources of wood procurement. Determine characteristics of current firewood users. Estimate demand for firewood in selected market areas in South Carolina. Investigate firewood marketing alternatives available to the nonindustrial private landowner.

PUBLICATIONS:82/01 82/12
MARSINKO, A.P. 1982. Using a Microcomputer as an Aid in Processing Data from Social Surveys. In: Microcomputers: A New Tool for Foresters, Conference Proceedings. Purdue University, W. Lafayette, Ind. (SAF Publication #SAF
MARSINKO, A.P. and WOOTEN, T.E. 1982. Firewood - Pickup Trucks, Cords, and Other Units of Measurement. Dept. of Forestry, Clemson Univ., Forestry Bull. No. 30.
MARSINKO, A.P. and WOOTEN, T.E. Pickup Trucks as Units for Measuring Firewood.
Accept for Pub., Forest Products Journal.

PRODUCTION, CONSUMPTION & MARKETING OF WOOD FOR ENERGY IN THE NORTHEAST

0087829
AGENCY: CSRS ME.
PERIOD: 01 JUL 82 TO 30 SEP 86
INVEST: FIELD D B
PROJECT#: ME08604
PERF ORG: FORESTRY
LOCATION: UNIVERSITY OF MAINE
ORONO ME

OBJECTIVES:Estimate the demand for wood energy by consuming sectors by state and for the Northeast. Analyze management and supply of wood for energy and processing and marketing structures. Identify goals and effectiveness of actual and alternative local, state and federal forest policies and contrast these with the objectives of forest owners in regard to wood for energy use

0088957
AGENCY: CSRS NH.
PERIOD: 01 JUL 82 TO 30 SEP 86
INVEST: ANDREWS R A; HOWARD T E; PARKER R G
PROJECT#: NH00287
PERF ORG: FOREST RESOURCES
LOCATION: UNIV OF NEW HAMPSHIRE
DURHAM NH

OBJECTIVES:Analyze management and supply of wood for energy and processing and marketing structures.

PRODUCTION, CONSUMPTION AND MARKETING OF WOOD FOR ENERGY IN THE NORTHEAST

0087828
AGENCY: CSRS RI.
PERIOD: 01 JUL 82 TO 30 SEP 86
INVEST: WEAVER T F; ANDERSON G D; GOULD W P

PROJECT#: RI00159
PERF ORG: RESOURCE ECONOMICS
LOCATION: UNIV OF RHODE ISLAND
KINGSTON RI

OBJECTIVES:To estimate the demand for wood energy by consuming sectors by state and for the northeast. To analyze management and supply of wood for energy and processing and marketing of structures. Identify goals and effectiveness of actual and alternative local, state, and federal forest policies and to contrast these with the objectives for forest owners in regard to wood for energy use.

0087757
AGENCY: CSRS VT.
PERIOD: 01 JUL 82 TO 30 SEP 86
INVEST: GILBERT A H
PROJECT#: VT00356
PERF ORG: AGRI & RESOURCE ECONOMICS
LOCATION: UNIVERSITY OF VERMONT
BURLINGTON VT

OBJECTIVES:To estimate the demand for wood energy by consuming sectors by state and for the Northeast, to analyze management and supply of wood for energy, and to identify goals and effectiveness of actual and alternative local, state, and federal forest policies and to contrast these with the objectives of forest owners in regard to wood for energy use.

WOOD AS AN ENERGY SOURCE IN THE RURAL-URBAN COMPLEX

0074337
AGENCY: CSRS RI.
PERIOD: 20 OCT 77 TO 19 OCT 83
INVEST: COULD W; BROWN J; MCKIEL C
PROJECT#: RI00960
PERF ORG: FORESTRY & WILDLIFE MANAGEMENT
LOCATION: UNIV OF RHODE ISLAND
KINGSTON RI

OBJECTIVES:Determine the potential demand for fuelwood in the southern New England rural-urban complex. Evaluate the productivity of typical sites for growing fuelwood. Assess ways to more efficiently use the resource by determining practical methods of seasoning wood.

NR1052 FOREST PRODUCTS PRICE REVIEW (FIREWOOD) - WISCONSIN

THE WISCONSIN FOREST PRODUCTS PRICE REPORT SERIES WAS INITIATED IN THE EARLY 1930'S. THREE EDITIONS ARE CURRENTLY COMPILED: TIMBER, BOLTWOOD AND LUMBER. SINCE 1978, THE BOLTWOOD EDITION HAS INCLUDED CURRENT MARKET INFORMATION ON DOMESTIC FIREWOOD, AN ALTERNATIVE ENERGY SOURCE FOR WISCONSIN HOMEOWNERS.
ABOUT 175 FIREWOOD PRODUCERS COOPERATE AS VOLUNTARY RESPONDENTS TO MAIL SURVEYS CONDUCTED BY EXTENSION FORESTERS.
TWO BOLTWOOD EDITIONS WERE COMPILED CONTAINING FIREWOOD MARKET INFORMATION. THESE REPORTS WERE MADE AVAILABLE TO CITIZENS THROUGH THE WISCONSIN-MICHIGAN TIMBER PRODUCERS MAGAZINE, THE WISCONSIN AGRICULTURIST FARM PAPER, A UNIVERSITY EXTENSION MAILING LIST AND THROUGH STATEWIDE UNIVERSITY EXTENSION COUNTY OFFICES.
THERE IS A CONTINUING NEED FOR CURRENT FIREWOOD MARKET INFORMATION FOR USE BY FOREST LANDOWNERS AND MANAGERS, FIREWOOD PRODUCERS, FIREWOOD RETAILERS AND PROFESSIONALS PROVIDING EDUCATIONAL AND TECHNICAL ASSISTANCE PROGRAMS. THERE IS NO ALTERNATIVE SOURCE OF INFORMATION.
*CONTACT
CONTACT PERSON THEODORE A. PETERSON
EXT. FORESTER
DEPT. OF FOR., UNIV. OF WI
1630 LINDEN DR.
MADISON, WI 53706
(608-262-0249)

WOOD PRODUCTS PROCESSING, MARKETING AND USE IN TEXAS NR88

THE WOOD PRODUCTS PROCESSING AND MARKETING PROGRAM IS PRIMARILY CONDUCTED IN EAST TEXAS, BUT THE CONSUMER EDUCATION ON WOOD USE IS STATEWIDE. THE PROGRAM PURPOSES ARE TO HELP THE FOREST INDUSTRY WITH ALTERNATIVE MARKETS, PROCESSING IMPROVEMENTS IN DRYING AND TIMBER PRODUCTION; AND CONSERVING TIMBER RESOURCES THROUGH IMPROVED PRODUCT SELECTION, USE AND MAINTENANCE. TARGET AUDIENCES ARE HOMEOWNERS, FOREST LANDOWNERS, FOREST INDUSTRY PERSONNEL, HOMEBUILDERS, ARCHITECTS AND LENDING AGENCY PERSONNEL. COOPERATIVE AGENCIES INCLUDE THE U. S. FOREST SERVICE, TEXAS FOREST SERVICE, TEXAS FORESTRY ASSOCIATION, SOUTHERN FOREST PRODUCTS ASSOCIATION AND SOUTHERN LUMBER EXPORTERS ASSOCIATION.
TWENTY-TWO CLINICS, ONE SHORT COURSE, ONE SEMINAR, 13 NEWS RELEASES, 13 RADIO TAPES, ONE PUBLICATION, ONE TV PROGRAM, 8,639 PUBLICATIONS DISTRIBUTED AND 267 PHONE CALLS AND 128 LETTERS WERE A PART OF THIS EDUCATIONAL PROGRAM. THE EDUCATIONAL PROGRAMS WERE ATTENDED BY 780 PEOPLE. INDUSTRY PERSONNEL WERE ASSISTED WITH KNOWLEDGE ON EXPORTING PROCEDURES TO CREATE ALTERNATIVE MARKETS THAT HAVE AN INCREASED VALUE OF 30 PERCENT. THEY ALSO LEARNED HOW TO PROPERLY KILN DRY LUMBER TO REDUCE DEGRADE AND ENERGY CONSUMPTION WHICH CAN INCREASE PROFITS BY 15 TO 20 PERCENT DEPENDING ON SPECIES. THREE INDIVIDUAL COMPANIES ALSO RECEIVED PERSONAL ASSISTANCE ON PROCESSING PROCEDURES WHICH RESULTED IN AN AVERAGE VALUE INCREASE OF 12.3 PERCENT. CONSUMER EDUCATION INCLUDED PRODUCT SELECTION, WOOD PRESERVATION, EXTERIOR PAINTING, WOOD ENERGY AND WOOD REFINISHING. WOOD ENERGY CAN REDUCE HEATING BILLS BY 50 PERCENT AND PROPER WOOD USE ACCOUNTS FOR AND AVERAGE 10 YEAR SAVINGS FOR HOMEOWNERS OF ALMOST $10,000.
*CONTACT
CONTACT PERSON CHARLES L. STAYTON
TEXAS AGRICULTURAL EXTENSION SERVICE
P. O. BOX 220
OVERTON, TX 75684
(214-834-6191)

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-420-931/NAL-609